X. APPENDIX

The present claims on appeal are as follows.

1413. A system configured to determine at least three properties of a specimen during use, comprising:

a stage configured to support the specimen during use;

a measurement device coupled to the stage, comprising:

an illumination system configured to direct energy toward a surface of the specimen during use; and

a detection system coupled to the illumination system and configured to detect energy propagating from the surface of the specimen during use, wherein the measurement device is configured to generate one or more output signals in response to the detected energy during use; and

a processor coupled to the measurement device and configured to determine a first property, a second property, and a third property of the specimen from the one or more output signals during use, wherein the first property comprises a critical dimension of the specimen, wherein the second property comprises a presence of defects on the specimen, wherein the defects comprise macro defects on a back side of the specimen, wherein the defects further comprise micro defects or macro defects on a front side of the specimen, wherein the specimen comprises a wafer, and wherein the third property comprises a thin film characteristic of the specimen.

1414. The system of claim 1413, wherein the stage is further configured to move laterally during use.

1415. The system of claim 1413, wherein the stage is further configured to move rotatably during use.

1416. The system of claim 1413, wherein the stage is further configured to move laterally and rotatably during use.

1417. The system of claim 1413, wherein the illumination system comprises a single energy source.

1418. The system of claim 1413, wherein the illumination system comprises more than one energy source.

1419. The system of claim 1413, wherein the detection system comprises a single energy sensitive device.

1420. The system of claim 1413, wherein the detection system comprises more than one energy sensitive devices.

1421. The system of claim 1413, wherein the measurement device further comprises a non-imaging scatterometer.

1422. The system of claim 1413, wherein the measurement device further comprises a scatterometer.

1423. The system of claim 1413, wherein the measurement device further comprises a spectroscopic scatterometer.

1424. The system of claim 1413, wherein the measurement device further comprises a reflectometer.

1425. The system of claim 1413, wherein the measurement device further comprises a spectroscopic reflectometer.

1426. The system of claim 1413, wherein the measurement device further comprises a coherence probe microscope.

1427. The system of claim 1413, wherein the measurement device further comprises a bright field imaging device.

1428. The system of claim 1413, wherein the measurement device further comprises a dark field imaging device.

1429. The system of claim 1413, wherein the measurement device further comprises a bright field and dark field imaging device.

1430. The system of claim 1413, wherein the measurement device further comprises a non-imaging bright field device.

1431. The system of claim 1413, wherein the measurement device further comprises a non-imaging dark field device.

1432. The system of claim 1413, wherein the measurement device further comprises a non-imaging bright field and dark field device.

1433. The system of claim 1413, wherein the measurement device further comprises an ellipsometer.

1434. The system of claim 1413, wherein the measurement device further comprises a spectroscopic ellipsometer.

1435. The system of claim 1413, wherein the measurement device further comprises a dual beam spectrophotometer.

1436. The system of claim 1413, wherein the measurement device further comprises a beam profile ellipsometer.

1437. The system of claim 1413, wherein the measurement device further comprises at least a first measurement device and a second measurement device, and wherein the first and second measurement devices are selected from the group consisting of a non-imaging scatterometer, a scatterometer, a spectroscopic scatterometer, a reflectometer, a spectroscopic reflectometer, a coherence probe microscope, a bright field imaging device, a dark field imaging device, a bright field and dark field imaging device, a non-imaging bright field device, a non-imaging dark field device, a non-imaging bright field and dark field device, an ellipsometer, a spectroscopic ellipsometer, a dual beam spectrophotometer, and a beam profile ellipsometer.

1438. The system of claim 1413, wherein the measurement device further comprises at least a first measurement device and a second measurement device, and wherein optical elements of the first measurement device comprise optical elements of the second measurement device.

1439. The system of claim 1413, wherein the defects further comprise micro defects and macro defects on a front side of the specimen.

1441. The system of claim 1413, wherein the thin film characteristic comprises a thickness of a copper film, and wherein the defects further comprise voids in the copper film.

1442. The system of claim 1413, wherein the macro defects comprise copper contamination.

1443. The system of claim 1413, wherein the processor is further configured to determine a fourth property of the specimen from the one or more output signals during use, and wherein the

fourth property is selected from the group consisting of a roughness of the specimen, a roughness of a layer on the specimen, and a roughness of a feature of the specimen.

1444. The system of claim 1443, wherein the system is coupled to a process tool selected from the group consisting of a lithography tool, an atomic layer deposition tool, a cleaning tool, and an etch tool.

1445. The system of claim 1413, wherein the illumination system is further configured to direct energy toward the back side of the specimen during use, and wherein the detection system is further configured to detect energy propagating from the back side of the specimen during use.

1447. The system of claim 1413, wherein the illumination system and the detection system comprise non-optical components, and wherein the detected energy is responsive to a non-optical characteristic of the surface of the specimen.

1448. The system of claim 1413, wherein the measurement device further comprises at least an eddy current device and a spectroscopic ellipsometer.

1449. The system of claim 1413, wherein the measurement device further comprises at least an eddy current device and a spectroscopic ellipsometer, and wherein the system is coupled to an atomic layer deposition tool.

1450. The system of claim 1413, wherein the system is further configured to determine at least three properties of the specimen substantially simultaneously during use.

1451. The system of claim 1413, wherein the illumination system is further configured to direct energy to multiple locations on the surface of the specimen substantially simultaneously, and wherein the detection system is further configured to detect energy propagating from the multiple locations on the surface of the specimen substantially simultaneously such that the first, second,

and third properties of the specimen at the multiple locations can be determined substantially simultaneously.

1452. The system of claim 1413, wherein the system is coupled to a process tool.

1453. The system of claim 1413, wherein the system is coupled to a process tool, and wherein the system is disposed within the process tool.

1454. The system of claim 1413, wherein the system is coupled to a process tool, and wherein the system is arranged laterally proximate to the process tool.

1455. The system of claim 1413, wherein the system is coupled to a process tool, and wherein the process tool comprises a wafer handler configured to move the specimen to the stage during use.

1456. The system of claim 1413, wherein the system is coupled to a process tool, and wherein the stage is configured to move the specimen from the system to the process tool during use.

1457. The system of claim 1413, wherein the system is coupled to a process tool, and wherein the stage is further configured to move the specimen to a process chamber of the process tool during use.

1458. The system of claim 1413, wherein the system is coupled to a process tool, and wherein the system is further configured to determine at least the two properties of the specimen while the specimen is waiting between process steps.

1459. The system of claim 1413, wherein the system is coupled to a process tool, and wherein the process tool comprises a support device configured to support the specimen during a process step, and wherein an upper surface of the support device is substantially parallel to an upper surface of the stage.

1460. The system of claim 1413, wherein the system is coupled to a process tool, wherein the process tool comprises a support device configured to support the specimen during a process step, and wherein an upper surface of the stage is angled with respect to an upper surface of the support device.

1461. The system of claim 1413, wherein the system is coupled to a process tool, and wherein the process tool is selected from the group consisting of a lithography tool, an etch tool, and a deposition tool.

1462. The system of claim 1413, wherein the system further comprises a measurement chamber, wherein the stage and the measurement device are disposed within the measurement chamber, and wherein the measurement chamber is coupled to a process tool.

1463. The system of claim 1413, wherein the system further comprises a measurement chamber, wherein the stage and the measurement device are disposed within the measurement chamber, and wherein the measurement chamber is disposed within a process tool.

1464. The system of claim 1413, wherein the system further comprises a measurement chamber, wherein the stage and the measurement device are disposed within the measurement chamber, and wherein the measurement chamber is arranged laterally proximate to a process chamber of a process tool.

1465. The system of claim 1413, wherein the system further comprises a measurement chamber, wherein the stage and the measurement device are disposed within the measurement chamber, and wherein the measurement chamber is arranged vertically proximate to a process chamber of a process tool.

1466. The system of claim 1413, wherein a process tool comprises a process chamber, wherein the stage is disposed within the process chamber, and wherein the stage is further configured to support the specimen during a process step.

1467. The system of claim 1466, wherein the processor is further configured to determine at least the three properties of the specimen during the process step.

1468. The system of claim 1467, wherein the processor is further configured to obtain a signature characterizing the process step during use, and wherein the signature comprises at least one singularity representative of an end of the process step.

1469. The system of claim 1467, wherein the processor is coupled to the process tool and is further configured to alter a parameter of one or more instruments coupled to the process tool in response to the determined properties using an in situ control technique during use.

1470. The system of claim 1413, wherein a process tool comprises a first process chamber and a second process chamber, and wherein the stage is further configured to move the specimen from the first process chamber to the second process chamber during use.

1471. The system of claim 1470, wherein the system is further configured to determine at least the three properties of the specimen as the stage is moving the specimen from the first process chamber to the second process chamber.

1472. The system of claim 1413, wherein the processor is further configured to compare at least one of the determined properties of the specimen and properties of a plurality of specimens during use.

1473. The system of claim 1413, wherein the processor is further configured to compare at least one of the determined properties of the specimen to a predetermined range for the property during use.

1474. The system of claim 1473, wherein the processor is further configured to generate an output signal if at least one of the determined properties of the specimen is outside of the predetermined range for the property during use.

1475. The system of claim 1413, wherein the processor is further configured to alter a sampling frequency of the measurement device in response to at least one of the determined properties of the specimen during use.

1476. The system of claim 1413, wherein the processor is further configured to alter a parameter of one or more instruments coupled to the measurement device in response to at least one of the determined properties using a feedback control technique during use.

1477. The system of claim 1413, wherein the processor is further configured to alter a parameter of one or more instruments coupled to the measurement device in response to at least one of the determined properties using a feedforward control technique during use.

1478. The system of claim 1413, wherein the processor is further configured to generate a database during use, and wherein the database comprises the determined first, second, and third properties of the specimen.

1479. The system of claim 1478, wherein the processor is further configured to calibrate the measurement device using the database during use.

1480. The system of claim 1478, wherein the processor is further configured to monitor output signals generated by measurement device using the database during use.

1481. The system of claim 1478, wherein the database further comprises first, second, and third properties of a plurality of specimens.

1482. The system of claim 1481, wherein the first, second, and third properties of the plurality of specimens are determined using the measurement device.

1483. The system of claim 1481, wherein the first, second, and third properties of the plurality of specimens are determined using a plurality of measurement devices.

1484. The system of claim 1483, wherein the processor is further coupled to the plurality of measurement devices.

1485. The system of claim 1484, wherein the processor is further configured to calibrate the plurality of measurement devices using the database during use.

1486. The system of claim 1485, wherein the processor is further configured to monitor output signals generated by the plurality of measurement devices using the database during use.

1487. The system of claim 1413, further comprising a stand alone system coupled to the system, wherein the stand alone system is configured to be calibrated with a calibration standard during use, and wherein the stand alone system is further configured to calibrate the system during use.

1488. The system of claim 1413, further comprising a stand alone system coupled to the system and at least one additional system, wherein the stand alone system is configured to be calibrated with a calibration standard during use, and wherein the stand alone system is further configured to calibrate the system and at least the one additional system during use.

1489. The system of claim 1413, wherein the system is further configured to determine at least the two properties of the specimen at more than one position on the specimen, and wherein the processor is configured to alter at least one parameter of one or more instruments coupled to a process tool in response to at least one of the determined properties of the specimen at the more than one position on the specimen to reduce within wafer variation of at least one of the determined properties.

1490. The system of claim 1413, wherein the processor is further coupled to a process tool.

1491. The system of claim 1490, wherein the processor is further configured to alter a parameter of one or more instruments coupled to the process tool in response to at least one of the determined properties using a feedback control technique during use.

1492. The system of claim 1490, wherein the processor is further configured to alter a parameter of one or more instruments coupled to the process tool in response to at least one of the determined properties using a feedforward control technique during use.

1493. The system of claim 1490, wherein the processor is further configured to monitor a parameter of one or more instruments coupled to the process tool during use.

1494. The system of claim 1493, wherein the processor is further configured to determine a relationship between at least one of the determined properties and at least one of the monitored parameters during use.

1495. The system of claim 1494, wherein the processor is further configured to alter a parameter of at least one of the instruments in response to the relationship during use.

1496. The system of claim 1413, wherein the processor is further coupled to a plurality of measurement devices, and wherein each of the plurality of measurement devices is coupled to at least one of a plurality of process tools.

1497. The system of claim 1413, wherein the processor comprises a local processor coupled to the measurement device and a remote controller computer coupled to the local processor, wherein the local processor is configured to at least partially process the one or more output signals during use, and wherein the remote controller computer is configured to further process the at least partially processed one or more output signals during use.

1498. The system of claim 1497, wherein the local processor is further configured to determine the first, second, and third properties of the specimen during use.

1499. The system of claim 1497, wherein the remote controller computer is further configured to determine the first, second, and properties of the specimen during use.

1500. A method for determining at least three properties of a specimen, comprising:

disposing the specimen upon a stage, wherein the stage is coupled to a measurement device, and wherein the measurement device comprises an illumination system and a detection system;

directing energy toward a surface of the specimen using the illumination system;

detecting energy propagating from the surface of the specimen using the detection system;

generating one or more output signals responsive to the detected energy; and

processing the one or more output signals to determine a first property, a second property, and a third property of the specimen, wherein the first property comprises a critical dimension of the specimen, wherein the second property comprises a presence of defects on the specimen, wherein the defects comprise macro defects on a back side of the specimen, wherein the defects further comprise micro defects or macro defects on a front side of the specimen, wherein the specimen comprises a wafer, and wherein the third property comprises a thin film characteristic of the specimen.

1583. A computer-implemented method for controlling a system configured to determine at least three properties of a specimen during use, wherein the system comprises a measurement device, comprising:

controlling the measurement device, wherein the measurement device comprises an illumination system and a detection system, and wherein the measurement device is coupled to a stage, comprising:

controlling the illumination system to direct energy toward a surface of the specimen;

controlling the detection system to detect energy propagating from the surface of the specimen; and

generating one or more output signals in response to the detected energy; and

processing the one or more output signals to determine a first property, a second property, and a third property of the specimen, wherein the first property comprises a critical dimension of the specimen, wherein the second property comprises a presence of defects on the specimen, wherein the defects comprise macro defects on a back side of the specimen, wherein the defects further comprise micro defects or macro defects on a front side of the specimen, wherein the specimen comprises a wafer, and wherein the third property comprises a thin film characteristic of the specimen.

1688. A method for fabricating a semiconductor device, comprising:

forming a portion of the semiconductor device upon a specimen;

disposing the specimen upon a stage, wherein the stage is coupled to a measurement device, and wherein the measurement device comprises an illumination system and a detection system;

directing energy toward a surface of the specimen using the illumination system;

detecting energy propagating from the surface of the specimen using the detection system;

generating one or more output signals responsive to the detected energy; and

processing the one or more output signals to determine a first property, a second property, and a third property of the specimen, wherein the first property comprises a critical dimension of the specimen, wherein the second property comprises a presence of defects

on the specimen, wherein the defects comprise macro defects on a back side of a specimen, wherein the defects further comprise micro defects or macro defects on a front side of the specimen, wherein the specimen comprises a wafer, and wherein the third property comprises a thin film characteristic of the portion of the specimen.

1709. A system configured to determine at least three properties of a specimen during use, comprising:

a stage configured to support the specimen during use;

a measurement device coupled to the stage, comprising:

an illumination system configured to direct energy toward a surface of the specimen during use; and

a detection system coupled to the illumination system and configured to detect energy propagating from the surface of the specimen during use, wherein the measurement device is configured to generate one or more output signals responsive to the detected energy during use;

a local processor coupled to the measurement device and configured to at least partially process the one or more output signals during use; and

a remote controller computer coupled to the local processor, wherein the remote controller computer is configured to receive the at least partially processed one or more output signals and to determine a first property, a second property, and a third property of the specimen from the at least partially processed one or more output signals during use, wherein the first property comprises a critical dimension of the specimen, wherein the second property comprises a presence of defects on the specimen, wherein the defects comprise macro defects on a back side of the specimen, wherein the defects further comprise micro defects or macro defects on a front side of the specimen, wherein the

specimen comprises a wafer, and wherein the third property comprises a thin film characteristic of the specimen.

1751. A method for determining at least three properties of a specimen, comprising:

disposing the specimen upon a stage, wherein the stage is coupled to a measurement device, and wherein the measurement device comprises an illumination system and a detection system;

directing energy toward a surface of the specimen using the illumination system;

detecting energy propagating from the surface of the specimen using the detection system;

generating one or more output signals responsive to the detected energy; and

processing the one or more output signals to determine a first property, a second property, and a third property of the specimen, wherein the first property comprises a critical dimension of the specimen, wherein the second property comprises a presence of defects on the specimen, wherein the defects comprise macro defects on a back side of the specimen, wherein the defects further comprise micro defects or macro defects on a front side of the specimen, wherein the specimen comprises a wafer, and wherein the third property comprises a thin film characteristic of the specimen, comprising:

at least partially processing the one or more output signals using a local processor, wherein the local processor is coupled to the measurement device;

sending the partially processed one or more output signals from the local processor to a remote controller computer; and

further processing the partially processed one or more output signals using the remote controller computer.